

ASC24 Service Manual



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ASC24 Controller Service Manual

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Index

<u>CIRCUIT DESCRIPTION</u>	<u>1</u>
PCB ARRANGEMENT.	1
SIGNAL FLOW	1
INPUT STAGE AND SUPERSONIC FILTER. PCB 664PA AND SCHEMATIC 664SA	1
LOW FREQUENCY SECTION: BAND 1 (BAND 3). PCB 664PD AND SCHEMATIC 664SD	1
HIGH FREQUENCY SECTION: BAND 2 (BAND 4). PCB 664PD AND SCHEMATIC 664SD	2
LEVEL CONTROLS: PCB 664P AND SCHEMATIC 664SA	2
LIMITERS: PCB 664PA AND SCHEMATIC 664SA	2
OUTPUT STAGE: PCB 664PA AND SCHEMATIC 664SA	4
MUTE: PCB 664PA AND SCHEMATIC 664SA	4
POWER SUPPLY: PCB 664PA AND SCHEMATIC 664SA	4
<u>TEST ROUTINES</u>	<u>5</u>
EQUIPMENT	5
LMS 664 UNIT TEST PROCEDURE V1.00	5
<u>SPECIFICATION</u>	<u>12</u>
<u>PARTS LIST</u>	<u>13</u>
<u>BLOCK DIAGRAM</u>	<u>25</u>
<u>CIRCUIT SCHEMATIC DIAGRAMS</u>	<u>26</u>
<u>FREQUENCY RESPONSE CURVES</u>	<u>33</u>

Circuit Description

Note: Channel 1 component references are shown directly and Channel 2 component references are enclosed in brackets.

Please refer to the Block diagram and the Circuit schematics when reading this section.

PCB Arrangement.

The main system PCB, 664PA carries the input stages, level potentiometers, limiters, output stages and the common power supply components.

Filter, (except input supersonic filter), phase and gain/attenuator circuitry is carried on the piggy-back option PCB 664PD.

PCB 660PB, carries all front panel indicator LEDs.

Signal Flow

The signal is processed in the following order: The input signal is RF filtered and de-balanced then HF filtered at 45kHz before it is sent to the Low frequency and High frequency band signal paths.

The Low band signal passes, in order, a subsonic filter, 10dB gain stage, all pass phase correction, 1st 12dB/oct Low pass filter, level control, mid band limiter, 2nd 12dB/oct Low pass filter, 10dB passive attenuator, electronically balanced output stage and relay mute.

The High band signal, in order, a buffer, a 6dB/oct rising CD equalizer stage, 1st 12dB/oct High pass filter, level control, mid band limiter, 2nd 12dB/oct High pass filter, 10dB passive attenuator, electronically balanced output stage and relay mute.

The individual stages are described in more detail below.

Input Stage and Supersonic Filter. PCB 664PA and Schematic 664SA

De-balancing: The input signal enters via CN1 (CN2), is DC blocked and de-balanced at unity gain by IC1-A (IC3-A).

Input filter: An 18dB/oct. 45kHz low pass filter to remove HF components which could produce undesirable audible effects. The signal is again DC blocked and passed to the first filter sections on PCB 664PD via CN3; The Low section, Band 1 (Band 3) on pin 14 (3) and the High section, Band 2 (Band 4) on pin 1 (12).

Low Frequency Section: Band 1 (Band 3). PCB 664PD and Schematic 664SD

Subsonic filter: The signal from CN1 pin 14 (3) is fed to an 18dB/oct 30Hz high pass subsonic filter, IC3-A (IC9-A).

Gain stage: IC3-B (IC9-B) is a 10dB Inverting gain stage. This gain, which is later removed by a passive attenuator, optimizes the dynamic range of the limiters and filters which follow, and in particular, improves the noise performance of the unit. The polarity inversion compensates for a further inversion in the output stage.

All-pass phase correction: An all-pass filter, IC1-A (IC7-A), is tuned to add phase correction at the crossover point. This improves acoustic summing between the low and high transducers in the crossover region.

1st Low pass filter (pre-limiter): A 12dB/oct 1kHz butterworth filter, IC1-B (IC7-B), defines the Low band crossover point. Its output signal is DC blocked and passed to CN1 pin 11 (9) to return to the level pot and limiter which is on PCB 664PA. The Channel 2 signal only passes through R21, 1k0, which is part of the level control structure, before reaching CN1 (pin 9).

Level control and Limiter: These are on PCB 664PA and are described later.

2nd Low pass filter (post-limiter): The filter input signal is derived from the limiter section via CN2 pin 13 (CN3 pin 13). A 12dB/oct 1kHz butterworth filter, IC16-A (IC17-A), defines the Low band crossover point.

Passive attenuator: The 2nd low pass filter feeds a 10dB passive attenuator consisting of R68 (R70) at 2k2 and R69 (R71) at 1k2. The net low band gain is unity. The signal is fed to the output stage via CN2 pin 9 (CN3 pin 9).

High Frequency Section: Band 2 (Band 4). PCB 664PD and Schematic 664SD

Buffer: The High signal from CN1 pin 1 (12) is buffered by IC6-A (IC6-B).

Constant directivity equalizer: IC5-A (IC4-A) is a 6dB/oct rising EQ, turning at 4kHz. This equalizer is responsible for the sloping high pass-band response which can be seen on the frequency response plot.

1st High pass filter (pre-limiter): A 12dB/oct 1kHz butterworth filter, IC1-B (IC7-B), defines the High band crossover point. Its output signal is DC blocked and passed to CN1 pin 10 (8) to return to the level pot and limiter which is on PCB 664PA.

Level control and limiter: These are on PCB 664PA and are described later.

2nd High pass filter (post-limiter): The filter input signal is derived from the limiter section via CN2 pin 7 (CN3 pin 7). A 12dB/oct 1kHz butterworth filter, IC16-A (IC17-A), defines the High band crossover point.

Passive attenuator: The 2nd high pass filter feeds a 10dB passive attenuator consisting of R66 (R72) at 2k2 and R67 (R73) at 1k2. The net high band gain is -10dB although this figure can only be measured at about 1.5kHz because of the effect of the CD EQ. The signal is fed to the output stage via CN2 pin 3 (CN3 pin 3).

Level Controls: PCB 664P and Schematic 664SA

The level controls use linear track potentiometers within a resistor network to achieve a nominal +/-6dB range around the center position (0dB on the scale). With the level control central this network introduces approximately 8dB of attenuation.

Limiters: PCB 664PA and Schematic 664SA

Principle of operation: The topology of the circuit is best described as a "Subtracting feed-back limiter". An op-amp is connected as a non-inverting amplifier in the main signal path and a VCA is connected between the input signal and the inverting input of the amplifier. When the input level exceeds the limiter threshold the VCA 'opens up', and a portion of the signal is subtracted, reducing the output and thus limiting the signal level. The control side chain monitors the output of the limiter and sends a control voltage back to the VCA at the input of the limiter, hence the description 'feed back'. The side chain signal is calibrated by a buffered attenuator which sets the threshold; it is then rectified and smoothed with appropriate time constants. The resulting varying DC signal is compared to a fixed DC reference voltage, and if this reference is exceeded, a proportional error signal is sent to the VCA control port. The rectified signal is also used to drive the 'signal', 'limit' and 'over' LEDs.

Limiter reference voltage: ZD1 produces an accurate and stable -2.5v DC reference which is common to all limiter sections. This reference determines the calibration of limiter thresholds and signal level LED indicators. Jumper JP1, when removed, drops the reference voltage to -15v effectively disabling the limiters (and the level indicator LEDs) as an aid to test and calibration. JP1 must ALWAYS BE REPLACED before the unit is put into service.

Low limiter: Band 1 (Band 3)

The subtracting amplifier, IC4-A (IC9-A) has a nominal gain of +8dB. Preset P1 (P6) is used to calibrate the band gain for the unit. The OP amp output is DC blocked.

The LM13700 VCA, IC2-A (IC8-A) is fed by a 22k/1k0 attenuator from the input signal. Its output is connected directly to the inverting input of the subtracting amplifier. Control voltage breakthrough to the VCA output is nulled by Preset P3 (P8).

Threshold calibration is performed in 1 dB steps by 16 position binary encoded switch SW3 (SW5) which controls 1dB, 2dB, 4dB and 8dB resistive attenuators. IC5-A (IC10-A) is a buffer to prevent interaction between the attenuators and IC5-B (IC10-B) buffers the output and adds 10dB gain. The output is DC blocked to prevent DC offset reaching the rectifier.

IC12-B (IC18-B) and IC12-A (IC18-A) form a precision full wave rectifier with a low output impedance when pulling negative (attacking) and a high output impedance when pulling positive (releasing). This is to allow a fast attack and slower release.

IC14-A (IC20-A) performs the dual task of time-constant integrator and threshold comparator. The time constant is determined by C45 (C61) in parallel with C47 (C57) making a total of 320nF. These capacitors are mounted on PCB 664PD and shown on schematic 664SD. The attack time is determined by 10k resistor R105 (R161) and the release time by 2k2 resistor R113 (R170) in series with R105 (R161) which discharge to the 2.5v ref voltage. When the rectified and integrated signal exceeds the reference voltage, the output of IC14-A (IC20-A) pulls positive from the negative rail and turns on the VCA via D5 (D15) and R114 (R171). The purpose of the diode is to ensure the VCA is securely clamped off when not limiting.

The 'limit' LEDs LD5 and LD6 (LD21 and LD22) are turned on by TR3 (TR11) as soon as the limiter is active. The 'over' LEDs LD7 and LD8 (LD23 and LD24) are turned on by TR4 (TR12) when the control voltage reaches about -5v referred to ground indicating approximately 6dB of limiting. The 'signal' LEDs LD3 and LD4 (LD19 and LD20) are driven directly from the rectifier output by TR1 and TR2 (TR9 and TR10). They illuminate when the signal level exceeds about 15dB below the limiter threshold. All the LEDs are mounted on PCB 660PB and connection between the PCBs is by 'flexstrip' ribbon cables CN5 (CN10).

High limiter: Band 2 (Band 4)

The high limiters are essentially identical to the low limiters but with faster time constants.

The subtracting amplifier, IC4-B (IC9-B) has a nominal gain of +8dB. Preset P2 (P7) is used to calibrate the band gain for the unit. The OP amp output is DC blocked.

The LM13700 VCA, IC2-B (IC8-B) is fed by a 22k/1k0 attenuator from the input signal. Its output is connected directly to the inverting input of the subtracting amplifier.

Threshold calibration is performed in 1 dB steps by 16 position binary encoded switch SW4 (SW6) which controls 1dB, 2dB, 4dB and 8dB resistive attenuators. IC6-A (IC11-A) is a buffer to prevent interaction between the attenuators and IC6-B (IC11-B) buffers the output and adds 10dB gain. The output is DC blocked to prevent DC offset reaching the rectifier. IC16-B (IC21-B) and IC18-A (IC21-B) form a precision full wave rectifier with a low output impedance when pulling negative (attacking) and a high output impedance when pulling positive (releasing). This is to allow a fast attack and slower release.

IC14-B (IC20-B) performs the dual task of time-constant integrator and threshold comparator. The time constant is determined by 33nF capacitors C46 (C62). These capacitors are mounted on PCB 664PD and shown on schematic 664SD. The attack time is determined by 10k resistor R138 (R188) and the release time by 2k2 resistor R139 (R172) in series with R138 (R188) which discharge to the 2.5v ref voltage. When the rectified and integrated signal exceeds the reference voltage, the output of IC14-B (IC20-B) pulls positive from the negative rail and turns on the VCA via D9 (D19) and R143 (R194). The purpose of the diode is to ensure the VCA is securely clamped off when not limiting.

The 'limit' LEDs LD13 and LD14 (LD29 and LD30) are turned on by TR7 (TR15) as soon as the limiter is active. The 'over' LEDs LD15 and LD16 (LD31 and LD32) are turned on by TR8 (TR16) when the control voltage reaches about -5v referred to ground indicating approximately 6dB of limiting. The 'signal' LEDs LD11 and LD12 (LD27 and LD28) are driven directly from the rectifier output by TR5 and TR6 (TR13 and TR14). They illuminate when the signal level exceeds about 15dB below the limiter threshold. All the LEDs are mounted on PCB 660PB and connection between the PCBs is by 'flexstrip' ribbon cables CN5 (CN10).

Output Stage: PCB 664PA and Schematic 664SA

The output stage is a standard electronically balanced and floating topology. It does not provide ground isolation. The Low output is built around IC13-A and IC13-B (IC17-A and IC17-B) and the high around IC15-A and IC15-B (IC19-A and IC19-B). Each section of OP amp is driven in anti phase, and the outputs are current limited by 47R resistors and cross coupled so that if either output is connected to ground, the opposing output gain doubles. Thus the output may be driven into a balanced or unbalanced load. The outputs are DC blocked.

Mute: PCB 664PA and Schematic 664SA

Mute is performed by a double pole relay connected directly before the output connector. The relay is in mute condition when it is unenergized. The relay coil is connected between the +15V rail and the -15V rail via the mute switch, limiting resistor and the auto mute enable circuit. A second pole on the mute switch activates the mute LEDs.

Auto Mute: PCB 664PA and Schematic 664SA

The auto mute circuit, TR19, TR18 and TR17 is designed to provide a delay when power is turned on before the mutes are released and mute quickly when power is turned off. It is common to all outputs. When power is applied, C82 turns TR19 hard on clamping the base of TR18. When C82 has charged up sufficiently TR19 turns off and TR18 turns on. TR17 is an emitter follower to supply the current required by the relays. D25 and D26 ensure that when the +/-15V rails fall TR18 is turned off rapidly and C82 is quickly discharged ready to provide the next turn on delay.

Power Supply: PCB 664PA and Schematic 664SA

The incoming mains supply is fused and connected to the transformer primary via the 115/230V selector switch SW9. When 230V is selected the primary sections are connected in series and for 115V they are connected in parallel. The split secondary is full wave rectified, smoothed and fused before being regulated by IC22 for the +15V rail and IC23 for the -15V rail. The power supply is common to both channels.

Test Routines

The test routine is based around Audio Precision test procedure 664.PRO which is available on floppy disk along with the required support files. This chapter describes the routine in general terms so that testing may be performed with simple equipment. If an Audio Precision test set is available it is highly recommended that the AP procedure be used.

Equipment

Audio Precision Test set

or

Signal generator: Low distortion sine wave, 20Hz to 50kHz. +20dBm max output.

Level/Noise meter: -90dBu to +20dBu, with switched 22kHz low pass filter.

THD test set:

Tone burst generator:

Oscilloscope: Single trace, 10MHz.

LMS 664 Unit Test Procedure V1.00

Test areas :-

- 1) Set up and inspect
- 2) Auto mute
- 3) Input / Output Sections.
- 4) Channel filter response.
- 5) CMRR.
- 6) Noise.
- 7) Distortion
- 8) Limiters.

1) Set up and inspect

- a). Inspect the unit thoroughly for any physical damage.
- b). Check that the Option PCB is secure and its cables connected.
- c). Move JP1 so that it is NOT shorting the 2 pins (Limiter canceled)
- d). Check that the mains voltage selector is correctly set and that the correct fuse value (115V: T315mA or 230V: T200mA) has been fitted.
- e). Switch on and check the power rails are all present and correct. (+15V on IC1 pin 8 and -15V on IC1 pin 4)
- f). Check that the Model window and the CH1\LOW to CH2\HIGH LEDs are lit.
- g). Check Pot knobs are centralized on shafts then set Level Controls Central, and Mute Switches out.
- h). Set Threshold switches to position 'F' (+5dBu).

2) Auto mute

[AP:- :IOTEST/r LT 664__GNL/r /F2..... Testing 'AUTOMUTE']

Input: Ch 1

Freq: 100Hz

Level: 0dBu

Output: Band 1 (Ch1 LF)

- * Monitor Band 1 & set level pot to read 0dB
- * Check that the unit mutes immediately power is switched off.
- * Re-apply Mains and check a 3-4 second delay before demute.

Note: Mute LEDs do not light during 'Auto Mute'.

'Auto Mute' needs testing on band 1 only

3) Input / Output Sections.

LF Bands

[AP:- :IOTEST/r LT 664__GNL/r /F2..... Calibrating GAIN, LEVEL & MUTE on LOW outputs]

Input: Ch1 & Ch2

Freq: 100Hz

Level: 0dBu

Output: Band 1 (Ch1 LF) and Band 3 (Ch2 LF) in turn.

* ** CENTRALIZE ALL LEVEL POTS **

For Band 1 & Band 3 in turn,

- * a) Calibrate to 0dBu with 'Gain' presets (+/-0.1dB).
- * b) On output XLR short pins 2 & 3 in turn to pin 1,
Check the level change is less than 0.5dB.
- * c) Check Pot range = +/-5.5dB to +/-7.0dB.
- * d) Accurately re-center LEVEL knob.
- * e) Check MUTE switch and LED.

HF Bands

[AP:- LT 664__GNH/r /F2..... Calibrating GAIN, LEVEL & MUTE on HIGH outputs]

Input: Ch1 & Ch2

Freq: 4400Hz

Level: +8dBu

Output: Band 2 (Ch1 HF) and Band 4 (Ch2 HF) in turn.

* ** CENTRALIZE ALL LEVEL POTS **

For Band 2 & Band 4 in turn,

- * a) Calibrate to 0dBu with 'Gain' presets (+/-0.1dB).
- * b) On output XLR short pins 2 & 3 in turn to pin 1,
Check the level change is less than 0.5dB.
- * c) Check Pot range = +/-5.5dB to +/-7.0dB.
- * d) Accurately re-center LEVEL knob.
- * e) Check MUTE switch and LED.

4) Channel filter response.

LF Bands

[AP:- :FILT/r LS 664__LF/r..... PREPARE FOR FREQUENCY RESPONSE SWEEPS]

Input: Ch1 & Ch2

Freq: Sweep 20Hz-2000Hz

Level: 0dBu

Output: Band 1 (Ch1 LF) and Band 3 (Ch2 LF) in turn.

* ** CENTRALIZE ALL LEVEL POTS **

For Band 1 & Band 3 in turn,

* Auto-sweep frequency from 20Hz to 2kHz

Check response is within limit traces on graph 'AP 664__LF'

* or For manual sweep:-

Check response is within tolerance of table:-

Frequency Hz	Amplitude dB	+/-dB
20	-13.6	1.0
30	-3.6	0.6
50	0.0	0.5
100	0.0	0.5
300	0.0	0.5
600	-1.0	0.5
1k0	-6.0	0.75
2k0	-24.0	1.0

HF Bands

[AP:- LS 664__HF/r..... PREPARE FOR FREQUENCY RESPONSE SWEEPS]

Input: Ch1 & Ch2

Freq: Sweep 800Hz-50kHz

Level: 0dBu

Output: Band 2 (Ch1 HF) and Band 4 (Ch2 HF) in turn.

* ** CENTRALIZE ALL LEVEL POTS **

For Band 2 & Band 4 in turn,

* Auto-sweep frequency from 800Hz to 50kHz

Check response is within limit traces on graph 'AP 664__HF'

* or For manual sweep:-

Check response is within tolerance of table:-

Frequency Hz	Amplitude dB	+/-dB
800	-20.0	1.0
1k0	-15.2	0.75
4k4	-8.0	0.5
10k	-5.0	0.5
20k	-0.8	1.0
40k	+2.1	1.0
50k	<+1.0	

5) CMRR.

Low frequency

[AP:- :CMRR/r LS 664_CMLF/r PREPARE FOR COMMON MODE REJECTION SWEEPS]

Input: Wire for common mode. i.e. hot=pin 2+3: cold=ground (=pin 1output XLR) = chassis.

Ch1 & Ch2 in turn

Freq: Sweep 50Hz-1000Hz

Level: +10dBu

Output: Band 1 (Ch1 LF) and Band 3 (Ch2 LF) in turn.

* ** CENTRALIZE ALL LEVEL POTS **

For Band 1 & Band 3 in turn,

* Sweep frequency from 50Hz to 1kHz
Check output < -70dB at all frequencies.

High frequency

[AP:- LS 664_CMHF/r]

Input: Wire for common mode. i.e. hot=pin 2+3: cold=ground (=pin 1output XLR) = chassis.

Ch1 & Ch2 in turn

Freq: Sweep 1000Hz-10kHz

Level: +10dBu

Output: Band 2 (Ch1 HF) and Band 4 (Ch2 HF) in turn.

* ** CENTRALIZE ALL LEVEL POTS **

For Band 2 & Band 4 in turn,

* Sweep frequency from 1kHz to 10kHz
Check output < -60dB at all frequencies.

6) Noise.

[AP:- :NOISE/r LT 1~NOISE/r /f2 UNIT NOISE FLOOR CHECK]

Input: None.

Output: All four bands in turn. Use Noise meter with 20 to 22kHz bandwidth

* ** CENTRALIZE ALL LEVEL POTS **

* Measure each output in turn.
Noise Floor on this unit should be :- < -95dBu.
And is typically :- < -98dB.

* ** Listen to the noise while checking the readings.**

* Check for DC level on the O/P XLR, pins 2 and 3.
Level should be < 10mV.

7) Distortion.

LF Bands

[AP:- :THD/r LS 664THDLF/r PREPARE FOR THD SWEEPS]

Input: Ch1 & Ch2

Freq: Sweep 50Hz-1000Hz

Level: +10dBu

Output: Band 1 (Ch1 LF) and Band 3 (Ch2 LF) in turn

* ** CENTRALIZE ALL LEVEL POTS **

For Band 1 & Band 3 in turn,

* Sweep frequency from 50Hz to 1kHz
Check THD < 0.02% at all frequencies.

HF Bands

[AP:- LS 664THDHF/r]

Input: Ch1 & Ch2

Freq: Sweep 2kHz-15kHz

Level: +3dBu

Output: Band 2 (Ch1 HF) and Band 4 (Ch2 HF) in turn

* ** CENTRALIZE ALL LEVEL POTS **

For Band 2 & Band 4 in turn,

* Sweep frequency from 2kHz to 15kHz
Check THD < 0.02% at all frequencies below 10kHz
Check THD < 0.05% at 15kHz.

8) Limiters

* Install limit cancel jumper JP1 over both pins.
Limiters are now active....

* Set all threshold switches to position '0' (-10dB).

LF Bands: LEDs

[AP:- :LIMS/r LT 664THRLF/r /F2 CHECK LED Calibration]

Input: Ch1 & Ch2

Freq: 50Hz

Level: Sweep -25dBu to 0dBu

Output: Measure INPUT SIGNAL LEVEL

For Band 1 & Band 3 together

* Sweep input level from -25dBu to -4dBu and observe LEDs.

* CHECK SIG LEDs light @ -24dB +/- 1 dB.

* LIMIT LEDs light @ -10 dB +/- 0.5dB.

* OVER LEDs light @ -5 dB +/- 0.5dB.

HF Bands: LEDs

[AP:- LT 664THRHF/r /F2 CHECK LED Calibration]

Input: Ch1 & Ch2

Freq: 4400Hz

Level: Sweep -17dBu to +3dBu

Output: Measure INPUT SIGNAL LEVEL

For Band 2 & Band 4 together

- * Sweep input level from -17dBu to +3dBu and observe LEDs
- * CHECK SIG LEDs light @ -16dB +/- 1 dB.
- * LIMIT LEDs light @ -2 dB +/- 0.5dB.
- * OVER LEDs light @ +2 dB +/- 0.5dB.

LF Bands: Limiters

[AP:- LT 664LIMLF/r Util Prompt..... LF Limiter Checks]

Input: Ch1 & Ch2

Freq: 50Hz

Level: Switch between -11dBu and -1dBu

Then sweep level to +9dBu

Output: Oscilloscope probe on IC4. & measure Band 1 (Ch1 LF) and Band 3 (Ch2 LF) in turn.

For Band 1 & Band 3 in turn

- * Set Scope timebase to 5mSec / div, ch2 input 0.5V /div DC coupled.
- * (Band 1): Put probe on IC4 / 1 and center the trace on the screen.
- * (Band 3): Put probe on IC4 / 7 and center the trace on the screen.
- * Toggle (switch) the level between -11dBu and -1dBu.
- * Adjust the appropriate OFFSET preset to keep the trace centered.
NB wait for the trace to settle after changing level, release should take 2 to 3 seconds, attack about 0.5 to 1 second.
- * Finally set Band 1 & 3 threshold switches to position C
Increase level to +9dbu and check limit level = +2dBu +/-0.25dB @ output.

HF Bands: Limiters

[AP:- LT 664LIMHF/r Util Prompt..... HF Limiter Checks]

Input: Ch1 & Ch2

Freq: 4400Hz

Level: Switch between -7dBu and +3dBu

Then sweep level to +5dBu

Output: Oscilloscope probe on IC9. & measure Band 2 (Ch1 HF) and Band 4 (Ch2 HF) in turn.

For Band 2 & Band 4 in turn

- * Set Scope timebase to 5mSec / div, ch2 input 0.5V /div DC coupled.
- * (Band 2): Put probe on IC9 / 1 and center the trace on the screen.
- * (Band 4): Put probe on IC9 / 7 and center the trace on the screen.
- * Toggle (switch) the level between -7dBu and +3dBu.
- * Adjust the appropriate OFFSET preset to keep the trace centered.
NB wait for the trace to settle after changing level, release
should take 1 to 2 seconds, attack about 0.2 to 0.5 second.
- * Finally set Band 2 & 4 threshold switches to position 1
Increase level to +5dbu and check limit level = -9dBu +/-0.25dB @ output.

End of test sequence.

Replace perspex lens in rear panel window and ensure no foreign articles are inside unit before replacing Cover plate.

Specification

Format: 2 input 4 output Stereo Crossover with limiters

Inputs: Electronically balanced XLR
Impedance: 16k Ohm
CMRR: < -70dB below 1kHz

Outputs: Electronically balanced XLR
Impedance: 600 Ohm load

Filters: Subsonic: 18dB/oct @ 30Hz
Crossover: 24dB/oct butterworth @ 1kHz
Supersonic 18db/oct @ 45kHz

EQ: High bands: 6dB/oct rising @ 4kHz

Band gain: Low bands: 0dB
High bands: -10dB nominal (EQ modified)

Level control: One per band, pre limiter, Continuous +/- 6dB about 0dB center

Mute: One per band: latching push switch controlling output relay

Automute: Auto mute delay at power on: instant mute at power off

Limiters: Independent mid filter limiter per band; attack and release optimized for band frequencies.
Ratio: <20:1
Threshold: Adjustable in 1dB steps from -10dBv to +5dBv

Distortion: <0.1% 30Hz 20kHz below limiter threshold; typically 0.005%

Noise: <-96dBu at any output.

AC supply: 115V or 230V switched +10% -20%; 50-60Hz

Dimensions: 1.75 x 19 x 11.5 inches

Net weight: 8.8 lbs

Parts List

PCB 664PA Parts References

REF	VALUE	STOCK NO.	DESCRIPTION
C1		C03-0050	100P CERAMIC
C2		C03-0050	100P CERAMIC
C3		C01-0040-J	4N7 POLYESTER
C4		C01-0120-J	100N POLYESTER
C5		C08-0007	47U 16V RAD NON-POLAR
C6		C03-0050	100P CERAMIC
C7		C01-0120-J	100N POLYESTER
C8		C07-0020-J	330P POLYSTYRENE
C9		C08-0007	47U 16V RAD NON-POLAR
C10		C01-0020	2N2 POLYESTER
C11		C03-0050	100P CERAMIC
C12		C08-0007	47U 16V RAD NON-POLAR
C13		C03-0050	100P CERAMIC
C14		C03-0050	100P CERAMIC
C15		C01-0040-J	4N7 POLYESTER
C16		C08-0007	47U 16V RAD NON-POLAR
C17		C03-0050	100P CERAMIC
C18		C07-0020-J	330P POLYSTYRENE
C19		C08-0007	47U 16V RAD NON-POLAR
C20		C01-0020	2N2 POLYESTER
C21		C08-0007	47U 16V RAD NON-POLAR
C22		C08-0007	47U 16V RAD NON-POLAR
C23		C03-0050	100P CERAMIC
C24		C08-0007	47U 16V RAD NON-POLAR
C26		C08-0007	47U 16V RAD NON-POLAR
C27		C08-0007	47U 16V RAD NON-POLAR
C31		C01-0120-J	100N POLYESTER
C36		C01-0120-J	100N POLYESTER
C41		C08-0007	47U 16V RAD NON-POLAR
C42		C08-0007	47U 16V RAD NON-POLAR
C43		C08-0007	47U 16V RAD NON-POLAR
C44		C08-0007	47U 16V RAD NON-POLAR
C45		C01-0120-J	100N POLYESTER
C46		C03-0040	47P CERAMIC
C47		C08-0060	220U 16V RAD NON-POLAR
C48		C08-0060	220U 16V RAD NON-POLAR
C49		C03-0040	47P CERAMIC
C50		C01-0120-J	100N POLYESTER
C51		C03-0040	47P CERAMIC
C52		C01-0120-J	100N POLYESTER
C53		C08-0060	220U 16V RAD NON-POLAR
C54		C01-0120-J	100N POLYESTER
C55		C08-0060	220U 16V RAD NON-POLAR
C56		C03-0040	47P CERAMIC
C57		C06-0040	22U 35V RAD ELECTROLYTIC
C58		C03-0040	47P CERAMIC
C59		C08-0060	220U 16V RAD NON-POLAR
C60		C08-0060	220U 16V RAD NON-POLAR
C61		C03-0040	47P CERAMIC
C62		C06-0040	22U 35V RAD ELECTROLYTIC
C63		C01-0120-J	100N POLYESTER

REF	VALUE	STOCK NO.	DESCRIPTION
C64		C03-0040	47P CERAMIC
C65		C08-0060	220U 16V RAD NON-POLAR
C66		C06-0040	22U 35V RAD ELECTROLYTIC
C67		C08-0060	220U 16V RAD NON-POLAR
C68		C03-0040	47P CERAMIC
C69		C01-0120-J	100N POLYESTER
C70		C01-0120-J	100N POLYESTER
C71		C01-0120-J	100N POLYESTER
C72		C06-0040	22U 35V RAD ELECTROLYTIC
C73		C06-0125	1000U 40V RAD ELECTROLYTIC
C74		C06-0125	1000U 40V RAD ELECTROLYTIC
C75		C01-0120-J	100N POLYESTER
C76		C01-0120-J	100N POLYESTER
C77		C01-0060-J	10N POLYESTER
C78		C06-0070	47U 25V RAD ELECTROLYTIC
C79		C06-0070	47U 25V RAD ELECTROLYTIC
C80		C01-0120-J	100N POLYESTER
C81		C01-0120-J	100N POLYESTER
C82		C06-0040	22U 35V RAD ELECTROLYTIC
CN1		L02-0230-J	XLR FEMALE PLASTIC NEUTRIK
CN2		L02-0230-J	XLR FEMALE PLASTIC NEUTRIK
CN3		L03-0110	14 WAY DIL 4" IDC MALE TO MALE
CONNECTOR			
CN5		L06-0010-J	8 WAY FLEXI STRIP 2"
CN6		L03-0110	14 WAY DIL 4" IDC MALE TO MALE
CONNECTOR			
CN7		L02-0200-J	XLR MALE PLASTIC NEUTRIK
CN8		L02-0200-J	XLR MALE PLASTIC NEUTRIK
CN9		L02-0200-J	XLR MALE PLASTIC NEUTRIK
CN10		L06-0010-J	8 WAY FLEXI STRIP 2"
CN11		L02-0200	XLR MALE PLASTIC NEUTRIK
CN12		L03-0110	14 WAY DIL 4" IDC MALE TO MALE
CONNECTOR			
CN13		L06-0010-J	8 WAY FLEXI STRIP 2"
D1		D01-0010	1N4148 DIODE
D2		D01-0010	1N4148 DIODE
D3		D01-0010	1N4148 DIODE
D4		D01-0010	1N4148 DIODE
D5		D01-0010	1N4148 DIODE
D6		D01-0010	1N4148 DIODE
D7		D01-0010	1N4148 DIODE
D8		D01-0010	1N4148 DIODE
D9		D01-0010	1N4148 DIODE
D10		D01-0010	1N4148 DIODE
D11		D01-0010	1N4148 DIODE
D12		D01-0010	1N4148 DIODE
D13		D01-0010	1N4148 DIODE
D14		D01-0010	1N4148 DIODE
D15		D01-0010	1N4148 DIODE
D16		D01-0010	1N4148 DIODE
D17		D01-0010	1N4148 DIODE
D18		D01-0010	1N4148 DIODE
D19		D01-0010	1N4148 DIODE
D20		D01-0010	1N4148 DIODE
D21		D01-0020	1N4002 DIODE
D22		D01-0020	1N4002 DIODE
D23		D01-0020	1N4002 DIODE

REF	VALUE	STOCK NO.	DESCRIPTION
D24		D01-0020	1N4002 DIODE
D25		D01-0010	1N4148 DIODE
D26		D01-0010	1N4148 DIODE
F1		M02-0050-J	20mm FUSE HOLDER
F2		M02-0050-J	20mm FUSE HOLDER
IC1		F01-0120	OP-AMP OP275GP (AN)
IC2		F01-0030-J	LF13700 OP-AMP
IC3		F01-0120	OP-AMP OP275GP (AN)
IC4		F01-0120	OP-AMP OP275GP (AN)
IC5		F01-0095	TL072 OP-AMP
IC6		F01-0095	TL072 OP-AMP
IC8		F01-0030-J	LF13700 OP-AMP
IC9		F01-0120	OP-AMP OP275GP (AN)
IC10		F01-0095	TL072 OP-AMP
IC11		F01-0095	TL072 OP-AMP
IC12		F01-0095	TL072 OP-AMP
IC13		F01-0120	OP-AMP OP275GP (AN)
IC14		F01-0095	TL072 OP-AMP
IC15		F01-0120	OP-AMP OP275GP (AN)
IC16		F01-0095	TL072 OP-AMP
IC17		F01-0120	OP-AMP OP275GP (AN)
IC18		F01-0095	TL072 OP-AMP
IC19		F01-0120	OP-AMP OP275GP (AN)
IC20		F01-0095	TL072 OP-AMP
IC21		F01-0095	TL072 OP-AMP
IC22		E03-0010	+15V REGULATOR 7815
IC23		E03-0020	-15V REGULATOR 7915
JP1	2/10ths	L04-0140	MALE HEADER 0.1" 10W GOLD
JP1		L02-0130	PC JUMPER
P1		A03-0061-J	20K PRESET 1T 3386H
P2		A03-0061-J	20K PRESET 1T 3386H
P3		A03-0021-J	500R PRESET 1T 3386H
P5	LIN	A04-0150-J	10K POT 6.5mm LIN
P6		A03-0061-J	20K PRESET 1T 3386H
P7		A03-0061-J	20K PRESET 1T 3386H
P8		A03-0021-J	500R PRESET 1T 3386H
P10	LIN	A04-0150-J	10K POT 6.5mm LIN
P11	LIN	A04-0150-J	10K POT 6.5mm LIN
P12	LIN	A04-0150-J	10K POT 6.5mm LIN
R1		A01-0432	47K 1/3W 1%
R2		A01-0260	2K2 1/3W 1%
R3		A01-0255	2K 1/3W 1%
R4		A01-0380	18K 1/3W 1%
R5		A01-0380	18K 1/3W 1%
R6		A01-0200	750R 1/3W 1%
R7		A01-0220	1K0 1/3W 1%
R8		A01-0220	1K0 1/3W 1%
R9		A01-0220	1K0 1/3W 1%
R10		A01-0220	1K0 1/3W 1%
R11		A01-0432	47K 1/3W 1%
R12		A01-0370	15K 1/3W 1%
R13		A01-0370	15K 1/3W 1%
R14		A01-0260	2K2 1/3W 1%
R15		A01-0432	47K 1/3W 1%
R16		A01-0390	22K 1/3W 1%
R17		A01-0390	22K 1/3W 1%
R18		A01-0295	3K9 1/3W 1%

REF	VALUE	STOCK NO.	DESCRIPTION
R19		A01-0432	47K 1/3W 1%
R20		A01-0432	47K 1/3W 1%
R21		A01-0260	2K2 1/3W 1%
R22		A01-0220	1K0 1/3W 1%
R23		A01-0195	680R 1/3W 1%
R24		A01-0195	680R 1/3W 1%
R25		A01-0255	2K 1/3W 1%
R26		A01-0350	10K 1/3W 1%
R27		A01-0350	10K 1/3W 1%
R28		A01-0315	5K6 1/3W 1%
R29		A01-0315	5K6 1/3W 1%
R30		A01-0350	10K 1/3W 1%
R31		A01-0432	47K 1/3W 1%
R32		A01-0240	1K5 1/3W 1%
R33		A01-0240	1K5 1/3W 1%
R34		A01-0390	22K 1/3W 1%
R35		A01-0390	22K 1/3W 1%
R36		A01-0260	2K2 1/3W 1%
R37		A01-0390	22K 1/3W 1%
R38		A01-0390	22K 1/3W 1%
R39		A01-0415	33K 1/3W 1%
R40		A01-0350	10K 1/3W 1%
R41		A01-0415	33K 1/3W 1%
R42		A01-0350	10K 1/3W 1%
R44		A01-0380	18K 1/3W 1%
R45		A01-0165	390R 1/3W 1%
R46		A01-0305	4K7 1/3W 1%
R47		A01-0380	18K 1/3W 1%
R48		A01-0165	390R 1/3W 1%
R49		A01-0305	4K7 1/3W 1%
R53		A01-0380	18K 1/3W 1%
R54		A01-0380	18K 1/3W 1%
R55		A01-0200	750R 1/3W 1%
R56		A01-0220	1K0 1/3W 1%
R57		A01-0220	1K0 1/3W 1%
R58		A01-0220	1K0 1/3W 1%
R59		A01-0370	15K 1/3W 1%
R60		A01-0370	15K 1/3W 1%
R61		A01-0390	22K 1/3W 1%
R62		A01-0390	22K 1/3W 1%
R65		A01-0432	47K 1/3W 1%
R66		A01-0432	47K 1/3W 1%
R67		A01-0195	680R 1/3W 1%
R68		A01-0195	680R 1/3W 1%
R69		A01-0350	10K 1/3W 1%
R70		A01-0350	10K 1/3W 1%
R71		A01-0220	1K0 1/3W 1%
R72		A01-0315	5K6 1/3W 1%
R73		A01-0315	5K6 1/3W 1%
R74		A01-0240	1K5 1/3W 1%
R75		A01-0240	1K5 1/3W 1%
R76		A01-0390	22K 1/3W 1%
R77		A01-0390	22K 1/3W 1%
R78		A01-0295	3K9 1/3W 1%
R79		A01-0390	22K 1/3W 1%
R80		A01-0415	33K 1/3W 1%
R81		A01-0350	10K 1/3W 1%

REF	VALUE	STOCK NO.	DESCRIPTION
R82		A01-0390	22K 1/3W 1%
R83		A01-0415	33K 1/3W 1%
R84		A01-0350	10K 1/3W 1%
R85		A01-0220	1K0 1/3W 1%
R86		A01-0380	18K 1/3W 1%
R87		A01-0165	390R 1/3W 1%
R88		A01-0305	4K7 1/3W 1%
R89		A01-0380	18K 1/3W 1%
R90		A01-0165	390R 1/3W 1%
R91		A01-0305	4K7 1/3W 1%
R92		A01-0350	10K 1/3W 1%
R93		A01-0350	10K 1/3W 1%
R94		A01-0432	47K 1/3W 1%
R95		A01-0330	7K5 1/3W 1%
R96		A01-0432	47K 1/3W 1%
R97		A01-0260	2K2 1/3W 1%
R98		A01-0047	47R 1/3W 1%
R99		A01-0370	15K 1/3W 1%
R100		A01-0505	330K 1/3W 1%
R101		A01-0465	100K 1/3W 1%
R102		A01-0230	1K2 1/3W 1%
R103		A01-0432	47K 1/3W 1%
R104		A01-0465	100K 1/3W 1%
R105		A01-0350	10K 1/3W 1%
R106		A01-0432	47K 1/3W 1%
R107		A01-0425	39K 1/3W 1%
R108		A01-0230	1K2 1/3W 1%
R109		A01-0432	47K 1/3W 1%
R110		A01-0270	2K7 1/3W 1%
R111		A01-0260	2K2 1/3W 1%
R112		A01-0047	47R 1/3W 1%
R113		A01-0260	2K2 1/3W 1%
R114		A01-0390	22K 1/3W 1%
R115		A01-0230	1K2 1/3W 1%
R116		A01-0260	2K2 1/3W 1%
R117		A01-0047	47R 1/3W 1%
R118		A01-0350	10K 1/3W 1%
R119		A01-0432	47K 1/3W 1%
R120		A01-0330	7K5 1/3W 1%
R121		A01-0432	47K 1/3W 1%
R122		A01-0220	1K0 1/3W 1%
R123		A01-0260	2K2 1/3W 1%
R124		A01-0370	15K 1/3W 1%
R125		A01-0505	330K 1/3W 1%
R126		A01-0465	100K 1/3W 1%
R127		A01-0230	1K2 1/3W 1%
R128		A01-0047	47R 1/3W 1%
R129		A01-0432	47K 1/3W 1%
R130		A01-0140	270R 1/3W 1%
R131		A01-0295	3K9 1/3W 1%
R132		A01-0260	2K2 1/3W 1%
R133		A01-0432	47K 1/3W 1%
R134		A01-0425	39K 1/3W 1%
R135		A01-0230	1K2 1/3W 1%
R136		A01-0047	47R 1/3W 1%
R137		A01-0465	100K 1/3W 1%
R138		A01-0350	10K 1/3W 1%

REF	VALUE	STOCK NO.	DESCRIPTION
R139		A01-0260	2K2 1/3W 1%
R140		A01-0432	47K 1/3W 1%
R141		A01-0270	2K7 1/3W 1%
R142		A01-0350	10K 1/3W 1%
R143		A01-0390	22K 1/3W 1%
R144		A01-0230	1K2 1/3W 1%
R145		A01-0140	270R 1/3W 1%
R146		A01-0260	2K2 1/3W 1%
R147		A01-0350	10K 1/3W 1%
R148		A01-0047	47R 1/3W 1%
R149		A01-0432	47K 1/3W 1%
R150		A01-0330	7K5 1/3W 1%
R151		A01-0432	47K 1/3W 1%
R152		A01-0230	1K2 1/3W 1%
R153		A01-0260	2K2 1/3W 1%
R154		A01-0047	47R 1/3W 1%
R155		A01-0370	15K 1/3W 1%
R156		A01-0505	330K 1/3W 1%
R157		A01-0465	100K 1/3W 1%
R158		A01-0432	47K 1/3W 1%
R159		A01-0230	1K2 1/3W 1%
R160		A01-0465	100K 1/3W 1%
R161		A01-0350	10K 1/3W 1%
R162		A01-0432	47K 1/3W 1%
R163		A01-0425	39K 1/3W 1%
R164		A01-0140	270R 1/3W 1%
R165		A01-0432	47K 1/3W 1%
R166		A01-0270	2K7 1/3W 1%
R167		A01-0230	1K2 1/3W 1%
R168		A01-0260	2K2 1/3W 1%
R169		A01-0047	47R 1/3W 1%
R170		A01-0260	2K2 1/3W 1%
R171		A01-0390	22K 1/3W 1%
R172		A01-0350	10K 1/3W 1%
R173		A01-0432	47K 1/3W 1%
R174		A01-0330	7K5 1/3W 1%
R175		A01-0432	47K 1/3W 1%
R176		A01-0140	270R 1/3W 1%
R177		A01-0220	1K0 1/3W 1%
R178		A01-0370	15K 1/3W 1%
R179		A01-0505	330K 1/3W 1%
R180		A01-0465	100K 1/3W 1%
R181		A01-0230	1K2 1/3W 1%
R182		A01-0432	47K 1/3W 1%
R183		A01-0295	3K9 1/3W 1%
R184		A01-0432	47K 1/3W 1%
R185		A01-0425	39K 1/3W 1%
R186		A01-0230	1K2 1/3W 1%
R187		A01-0465	100K 1/3W 1%
R188		A01-0350	10K 1/3W 1%
R189		A01-0260	2K2 1/3W 1%
R190		A01-0432	47K 1/3W 1%
R191		A01-0270	2K7 1/3W 1%
R192		A01-0220	1K0 1/3W 1%
R193		A01-0350	10K 1/3W 1%
R194		A01-0390	22K 1/3W 1%
R195		A01-0230	1K2 1/3W 1%

REF	VALUE	STOCK NO.	DESCRIPTION
R196		A01-0195	680R 1/3W 1%
R197		A01-0195	680R 1/3W 1%
R198		A01-0195	680R 1/3W 1%
R199		A01-0305	4K7 1/3W 1%
R200		A01-0495	220K 1/3W 1%
R201		A01-0390	22K 1/3W 1%
R202		A01-0432	47K 1/3W 1%
RLY1		K06-0010-J	2 POLE CHANGE OVER RELAY
RLY2		K06-0010-J	2 POLE CHANGE OVER RELAY
RLY3		K06-0010-J	2 POLE CHANGE OVER RELAY
RLY4		K06-0010-J	2 POLE CHANGE OVER RELAY
RN1		A08-0010	10K RES-PACK 2% 4-ISO
RN2		A08-0010	10K RES-PACK 2% 4-ISO
RN5		A08-0010	10K RES-PACK 2% 4-ISO
RN6		A08-0010	10K RES-PACK 2% 4-ISO
RN7		A08-0010	10K RES-PACK 2% 4-ISO
RN8		A08-0010	10K RES-PACK 2% 4-ISO
RN9		A08-0010	10K RES-PACK 2% 4-ISO
RN10		A08-0010	10K RES-PACK 2% 4-ISO
RN11		A08-0010	10K RES-PACK 2% 4-ISO
RN12		A08-0010	10K RES-PACK 2% 4-ISO
SP1		L05-0155	1/8" SPADE TERMINAL
SP2		L05-0155	1/8" SPADE TERMINAL
SP3		L05-0155	1/8" SPADE TERMINAL
SP4		L05-0155	1/8" SPADE TERMINAL
SP5		L05-0155	1/8" SPADE TERMINAL
SP6		L05-0155	1/8" SPADE TERMINAL
SP7		L05-0155	1/8" SPADE TERMINAL
SP8		L05-0155	1/8" SPADE TERMINAL
SP9		L05-0155	1/8" SPADE TERMINAL
SP10		L05-0155	1/8" SPADE TERMINAL
SW1		K03-0150	SWITCH MIN ALPS 4P
SW2		K03-0150	SWITCH MIN ALPS 4P
SW3		K05-0040	BCM16 ROTARY SWITCH 10 WAY HORIZONTAL
SW4		K05-0040	BCM16 ROTARY SWITCH 10 WAY HORIZONTAL
SW5		K05-0040	BCM16 ROTARY SWITCH 10 WAY HORIZONTAL
SW6		K05-0040	BCM16 ROTARY SWITCH 10 WAY HORIZONTAL
SW7		K03-0150	SWITCH MIN ALPS 4P
SW8		K03-0150	SWITCH MIN ALPS 4P
SW9		K02-0010	SWITCH 115/230 PCB RT ANGLE
TR1		E01-0010	BC212 TRANSISTOR
TR2		E01-0020	BC182 TRANSISTOR
TR3		E01-0020	BC182 TRANSISTOR
TR4		E01-0020	BC182 TRANSISTOR
TR5		E01-0010	BC212 TRANSISTOR
TR6		E01-0020	BC182 TRANSISTOR
TR7		E01-0020	BC182 TRANSISTOR
TR8		E01-0020	BC182 TRANSISTOR
TR9		E01-0010	BC212 TRANSISTOR
TR10		E01-0020	BC182 TRANSISTOR
TR11		E01-0020	BC182 TRANSISTOR
TR12		E01-0020	BC182 TRANSISTOR
TR13		E01-0010	BC212 TRANSISTOR
TR14		E01-0020	BC182 TRANSISTOR
TR15		E01-0020	BC182 TRANSISTOR
TR16		E01-0020	BC182 TRANSISTOR
TR17		E01-0010	BC212 TRANSISTOR

REF	VALUE	STOCK NO.	DESCRIPTION
TR18		E01-0020	BC182 TRANSISTOR
TR19		E01-0020	BC182 TRANSISTOR
TX1		P01-0020-J	TOROID TX 7794
ZD1		D05-0010	2.5V VOLTAGE REF

PANEL MOUNTED Parts Reference

---	M02-0020-J	FUSE HOLDER PANEL MTG
---	N01-0100	KNOB S101 4mm BLACK
---	N01-0045	KNOB CAP C101 BLACK
---	N04-0045	SWITCH CAP MIN ALP BLACK
---	L07-0020	IEC - USA PLUG CORDSET

PCB 664PD Parts References

REF	VALUE	STOCK NO.	DESCRIPTION
C1		C01-0070-J	15N POLYESTER
C3		C01-0138	470N POLYESTER
C4		C01-0138	470N POLYESTER
C5		C01-0138	470N POLYESTER
C6		C01-0120-J	100N POLYESTER
C7		C01-0120-J	100N POLYESTER
C8		C08-0007	47U 16V RAD NON-POLAR
C9		C01-0060-J	10N POLYESTER
C10		C01-0060-J	10N POLYESTER
C11		C01-0060-J	10N POLYESTER
C14		C03-0050	100P CERAMIC
C15		C03-0050	100P CERAMIC
C16		C08-0007	47U 16V RAD NON-POLAR
C17		C01-0060-J	10N POLYESTER
C18		C01-0060-J	10N POLYESTER
C19		C01-0015-J	1N5 POLYESTER
C20		C08-0007	47U 16V RAD NON-POLAR
C21		C01-0060-J	10N POLYESTER
C22		C01-0060-J	10N POLYESTER
C23		C01-0015-J	1N5 POLYESTER
C24		C01-0070-J	15N POLYESTER
C26		C01-0138	470N POLYESTER
C27		C01-0138	470N POLYESTER
C28		C01-0138	470N POLYESTER
C29		C08-0007	47U 16V RAD NON-POLAR
C30		C01-0060-J	10N POLYESTER
C31		C01-0060-J	10N POLYESTER
C32		C01-0060-J	10N POLYESTER
C45		C01-0130	220N POLYESTER
C46		C01-0090-J	33N POLYESTER
C47		C01-0120-J	100N POLYESTER
C51		C01-0060-J	10N POLYESTER
C52		C01-0060-J	10N POLYESTER
C53		C01-0060-J	10N POLYESTER
C54		C01-0060-J	10N POLYESTER
C55		C01-0060-J	10N POLYESTER
C56		C01-0060-J	10N POLYESTER
C57		C01-0120-J	100N POLYESTER
C59		C01-0120-J	100N POLYESTER
C60		C01-0120-J	100N POLYESTER
C61		C01-0130	220N POLYESTER
C62		C01-0090-J	33N POLYESTER
C63		C01-0060-J	10N POLYESTER
C64		C01-0060-J	10N POLYESTER
C65		C06-0070	47U 25V RAD ELECTROLYTIC
C66		C06-0070	47U 25V RAD ELECTROLYTIC
C67		C01-0060-J	10N POLYESTER
C68		C01-0060-J	10N POLYESTER
IC1		F01-0095	TL072 OP-AMP
IC3		F01-0095	TL072 OP-AMP
IC4		F01-0095	TL072 OP-AMP
IC5		F01-0095	TL072 OP-AMP
IC6		F01-0095	TL072 OP-AMP

REF	VALUE	STOCK NO.	DESCRIPTION
=====			
IC7		F01-0095	TL072 OP-AMP
IC9		F01-0095	TL072 OP-AMP
IC16		F01-0095	TL072 OP-AMP
IC17		F01-0095	TL072 OP-AMP
R1		A01-0325	6K8 1/3W 1%
R2		A01-0360	12K 1/3W 1%
R3		A01-0360	12K 1/3W 1%
R4		A01-0390	22K 1/3W 1%
R9		A01-0260	2K2 1/3W 1%
R10		A01-0445	68K 1/3W 1%
R12		A01-0355	11K 1/3W 1%
R15		A01-0295	3K9 1/3W 1%
R18		A01-0355	11K 1/3W 1%
R20		A01-0360	12K 1/3W 1%
R21		A01-0220	1K0 1/3W 1%
R22		A01-0360	12K 1/3W 1%
R23		A01-0240	1K5 1/3W 1%
R24		A01-0360	12K 1/3W 1%
R25		A01-0240	1K5 1/3W 1%
R27		A01-0360	12K 1/3W 1%
R28		A01-0360	12K 1/3W 1%
R30	N.U.		
R31		A01-0360	12K 1/3W 1%
R32		A01-0360	12K 1/3W 1%
R33		A01-0355	11K 1/3W 1%
R35		A01-0390	22K 1/3W 1%
R37		A01-0355	11K 1/3W 1%
R39		A01-0390	22K 1/3W 1%
R42		A01-0360	12K 1/3W 1%
R43		A01-0360	12K 1/3W 1%
R45	N.U.		
R46		A01-0325	6K8 1/3W 1%
R47		A01-0360	12K 1/3W 1%
R48		A01-0360	12K 1/3W 1%
R49		A01-0390	22K 1/3W 1%
R54		A01-0260	2K2 1/3W 1%
R55		A01-0445	68K 1/3W 1%
R57		A01-0355	11K 1/3W 1%
R60		A01-0295	3K9 1/3W 1%
R63		A01-0355	11K 1/3W 1%
R65		A01-0360	12K 1/3W 1%
R66		A01-0260	2K2 1/3W 1%
R67		A01-0230	1K2 1/3W 1%
R68		A01-0260	2K2 1/3W 1%
R69		A01-0230	1K2 1/3W 1%
R70		A01-0260	2K2 1/3W 1%
R71		A01-0230	1K2 1/3W 1%
R72		A01-0260	2K2 1/3W 1%
R73		A01-0230	1K2 1/3W 1%
R103		A01-0355	11K 1/3W 1%
R104		A01-0355	11K 1/3W 1%
R107		A01-0355	11K 1/3W 1%
R109		A01-0355	11K 1/3W 1%
R111		A01-0355	11K 1/3W 1%
R112		A01-0390	22K 1/3W 1%
R114		A01-0355	11K 1/3W 1%
R116		A01-0390	22K 1/3W 1%

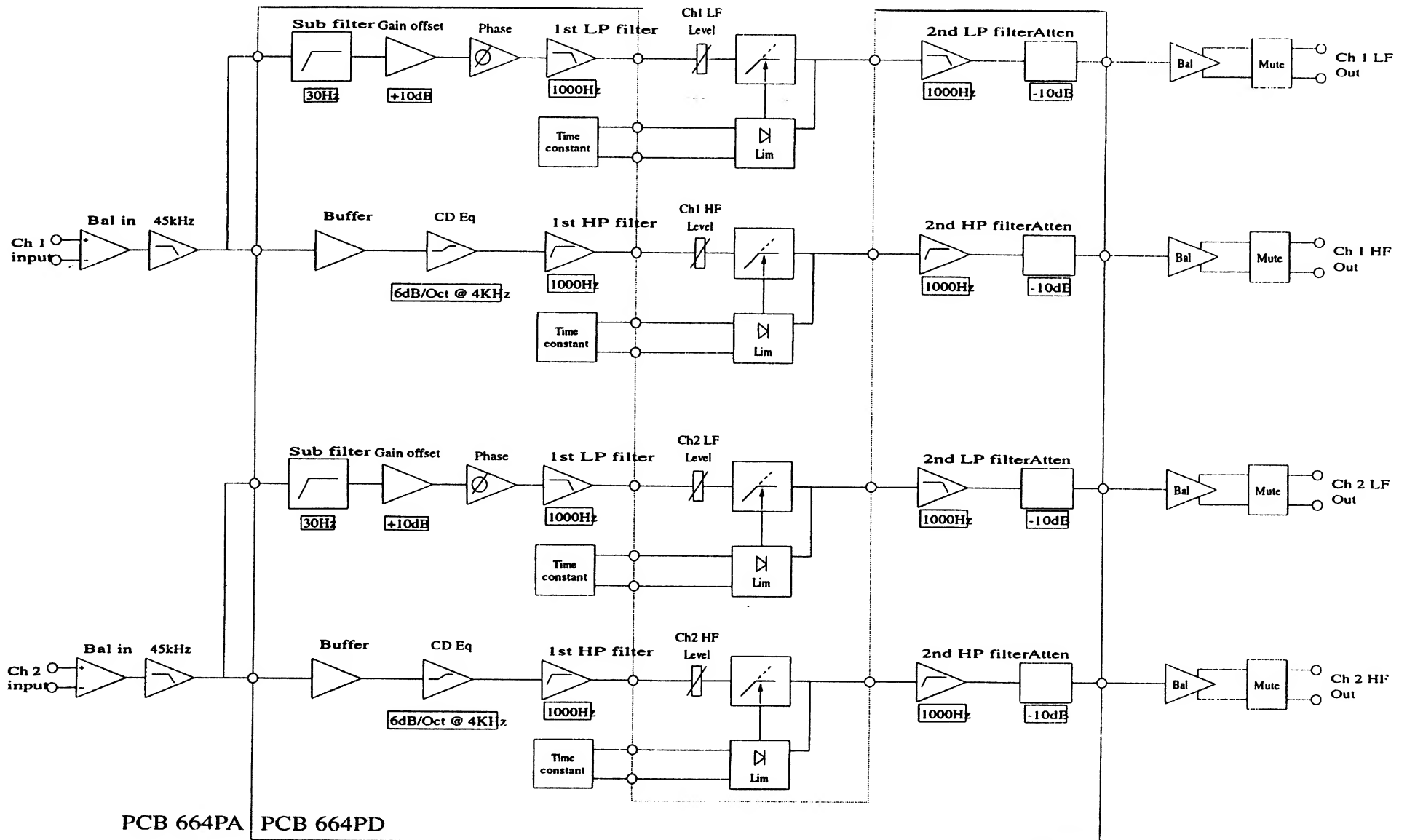
PCB 660PB Parts References

REF	VALUE	STOCK NO.	DESCRIPTION
LD1	RED	J03-0010-J	LED RED 3mm SQUARE
LD2	RED	J03-0010-J	LED RED 3mm SQUARE
LD3	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD4	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD5	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD6	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD7	RED	J03-0010-J	LED RED 3mm SQUARE
LD8	RED	J03-0010-J	LED RED 3mm SQUARE
LD9	RED	J03-0010-J	LED RED 3mm SQUARE
LD10	RED	J03-0010-J	LED RED 3mm SQUARE
LD11	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD12	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD13	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD14	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD15	RED	J03-0010-J	LED RED 3mm SQUARE
LD16	RED	J03-0010-J	LED RED 3mm SQUARE
LD17	RED	J03-0010-J	LED RED 3mm SQUARE
LD18	RED	J03-0010-J	LED RED 3mm SQUARE
LD19	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD20	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD21	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD22	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD23	RED	J03-0010-J	LED RED 3mm SQUARE
LD24	RED	J03-0010-J	LED RED 3mm SQUARE
LD25	RED	J03-0010-J	LED RED 3mm SQUARE
LD26	RED	J03-0010-J	LED RED 3mm SQUARE
LD27	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD28	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD29	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD30	ORG	J03-0030	LED ORANGE 3mm SQUARE
LD31	RED	J03-0010-J	LED RED 3mm SQUARE
LD32	RED	J03-0010-J	LED RED 3mm SQUARE
LD33	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD34	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD35	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD36	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD37	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD38	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD39	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD40	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD41	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD42	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD43	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD44	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD45	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD46	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD47	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD48	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD49	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD50	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD51	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD52	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD53	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD54	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD55	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD56	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD57	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD58	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD59	GRN	J03-0020-J	LED GREEN 3mm SQUARE

REF	VALUE	STOCK NO.	DESCRIPTION
LD60	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD61	GRN	J03-0020-J	LED GREEN 3mm SQUARE
LD62	GRN	J03-0020-J	LED GREEN 3mm SQUARE

JBL **ASC 24**
ASC 24 SYSTEM CONTROLLER

D.O. Ref.	SJG	1/30/95
Drawing No.	664BA-2 DWG	Issue 2



DRAWING NUMBER ISSUE

664SA 2

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TITLE: INPUT & COMMON CIRCUITS

FILENAME: 664SA2.SCH

DRAWN BY: SJG/TJR

DATE: 10/1/95

CHECKED:

LAYERS: SHEET 1 OF 6

ISSUE DETAILS

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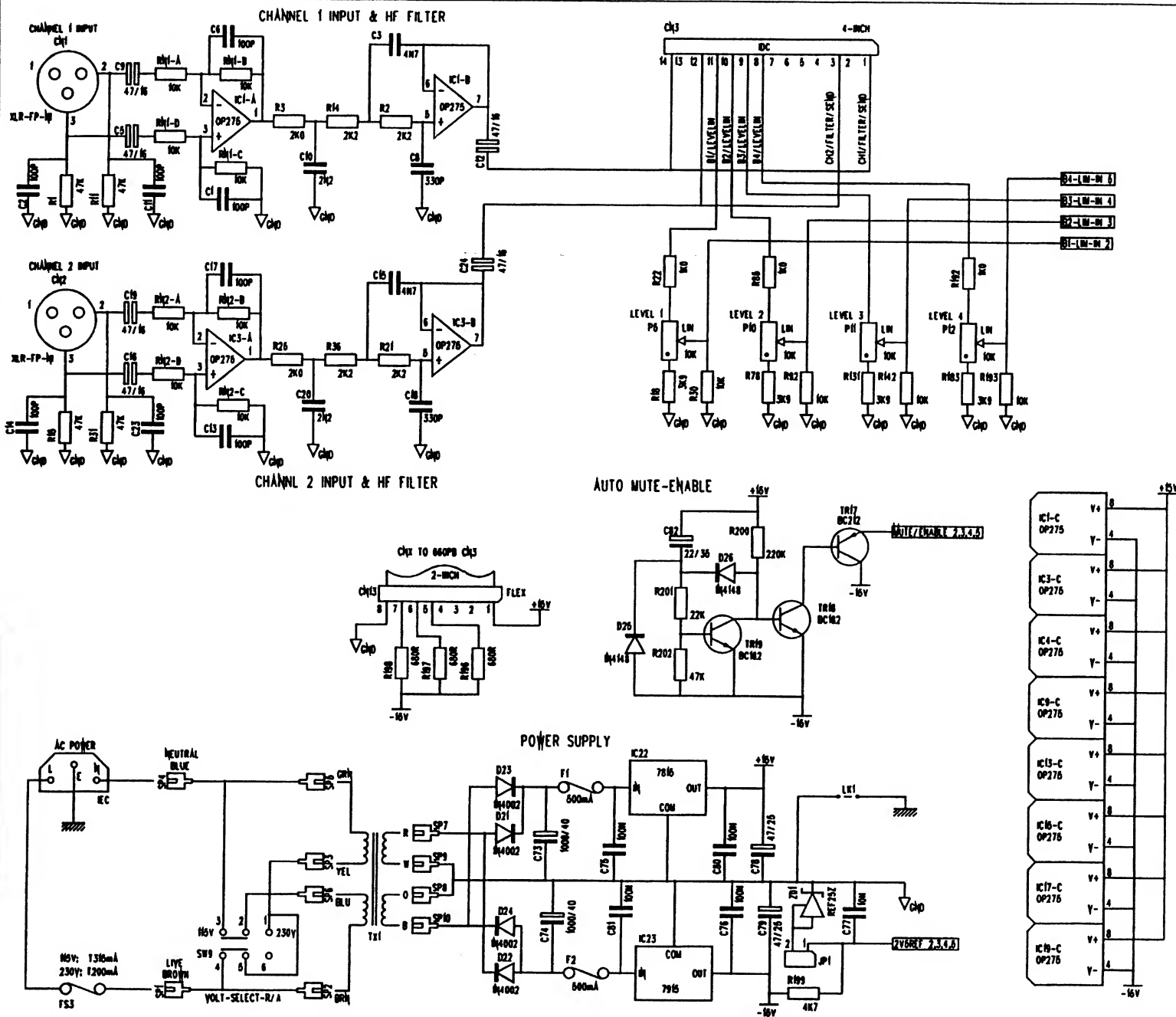
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LAYERS: SHEET 2 OF 5

ISSUE DETAILS

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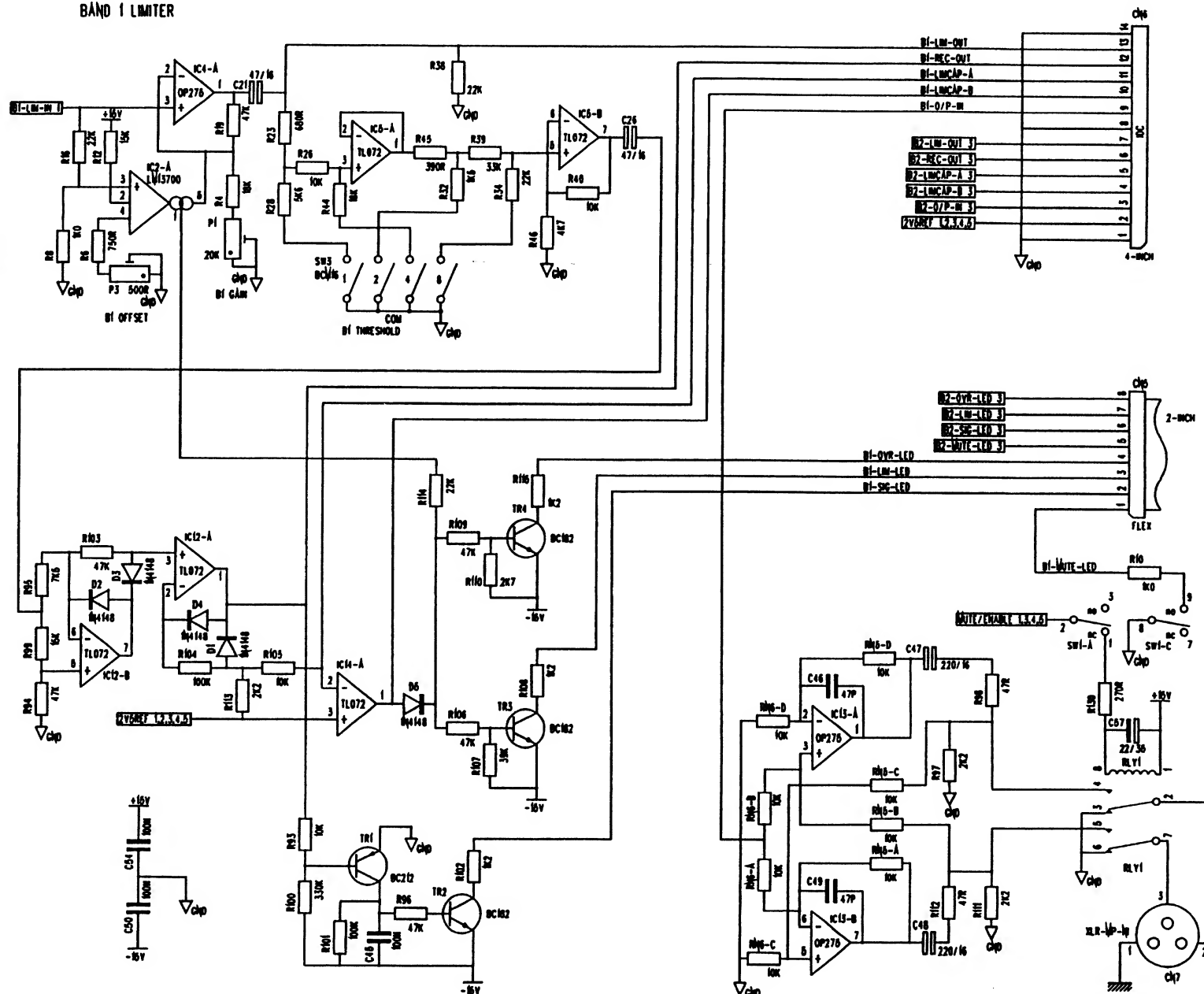
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LAYERS: SHEET 3 OF 6

ISSUE DETAILS

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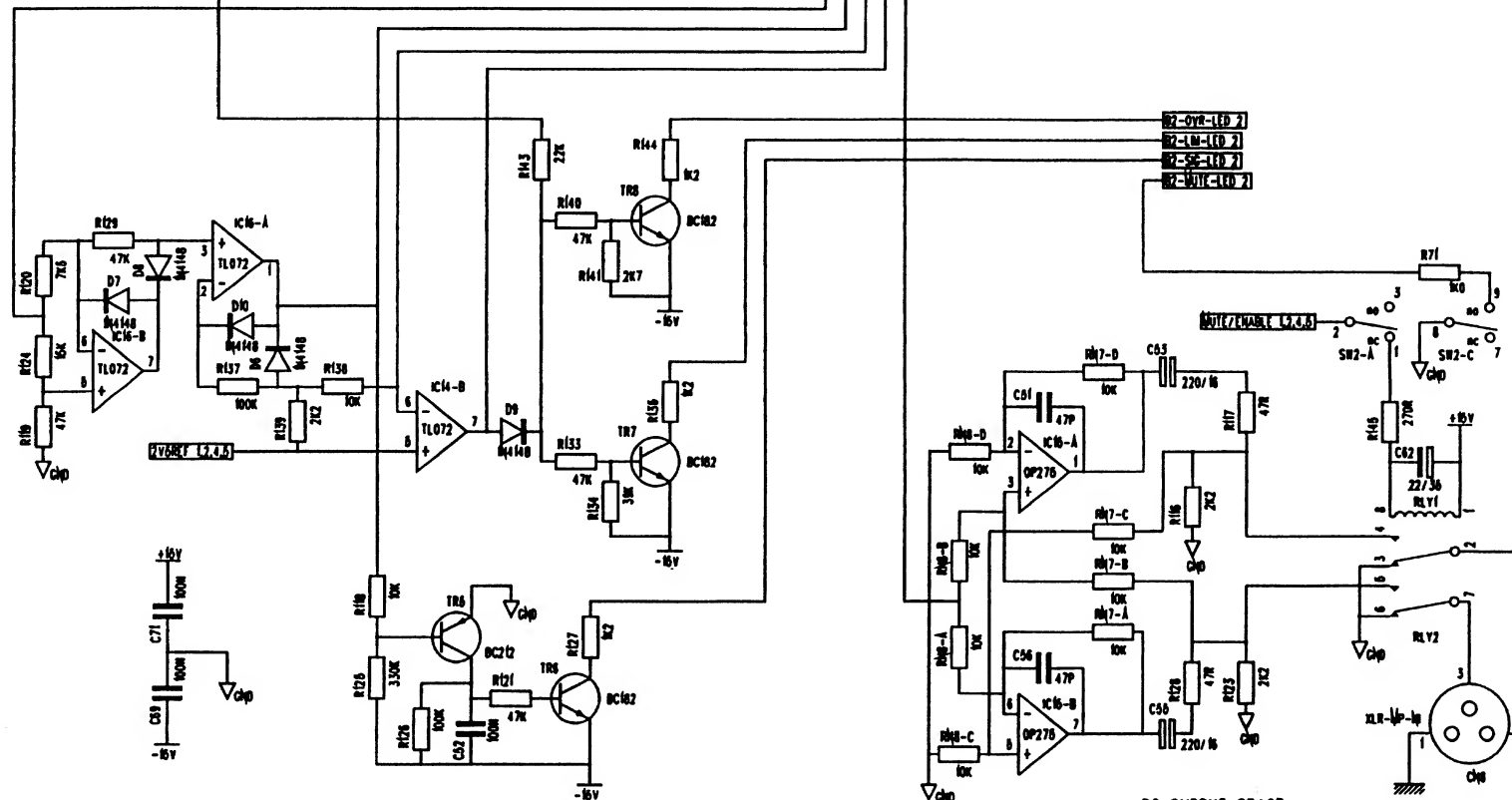
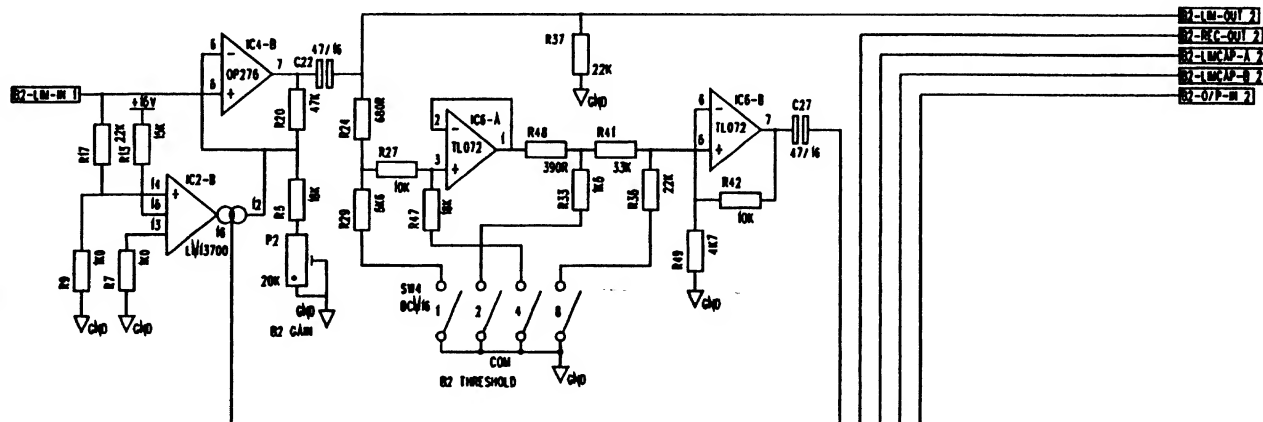
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LAYERS: SHEET 4 OF 5

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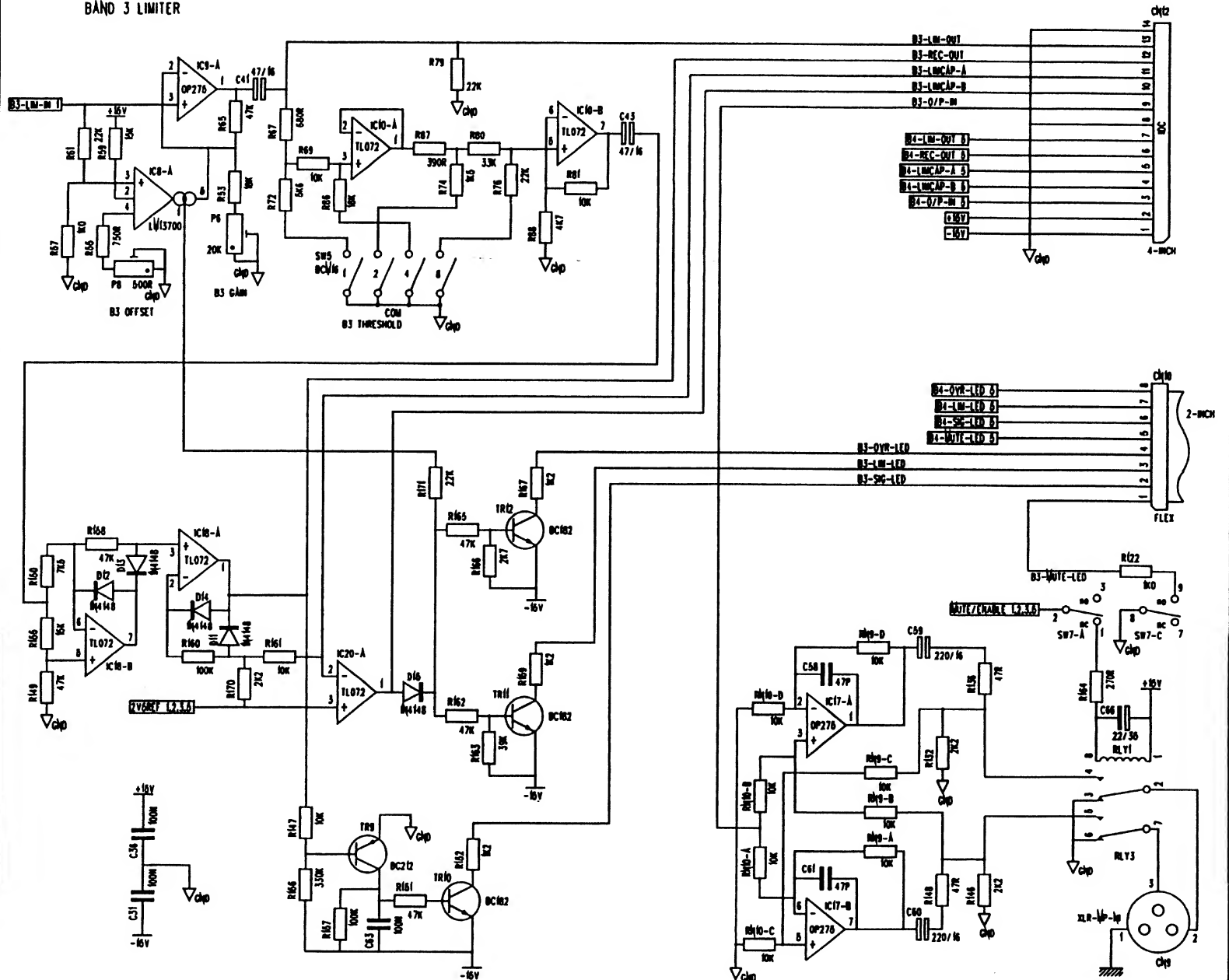
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B3 OUTPUT STAGE

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TITLE: BAND 4 MAIN CIRCUIT

FILENAME: 664SA2.SCH

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DATE: 10/1/95

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LAYERS: SHEET 5 OF 5

ISSUE DETAILS

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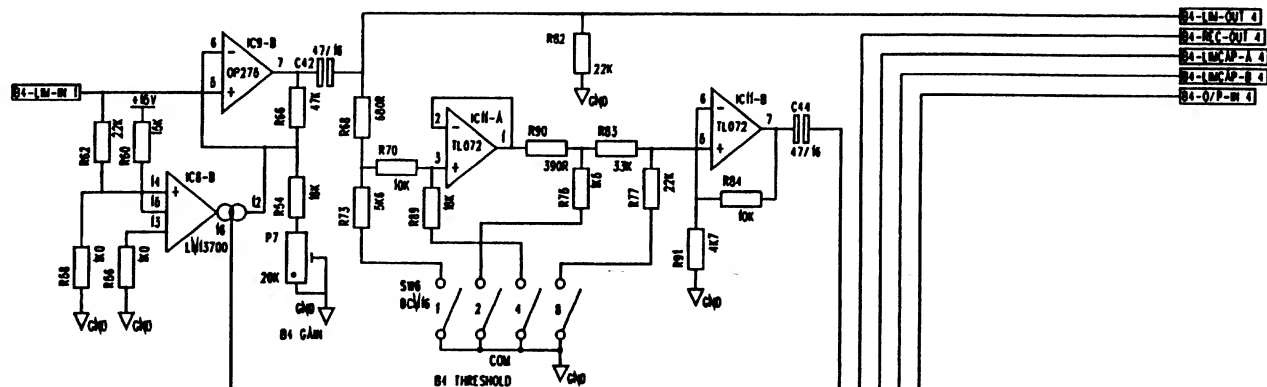
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ISSUE

2



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TITLE : OPTION BOARD

FILENAME: 664SD2.SCH

DRAWN BY: SJG

DATE: 10/1/95

CHECKED :

LAYERS: SHEET 1 OF 1

ISSUE DETAILS

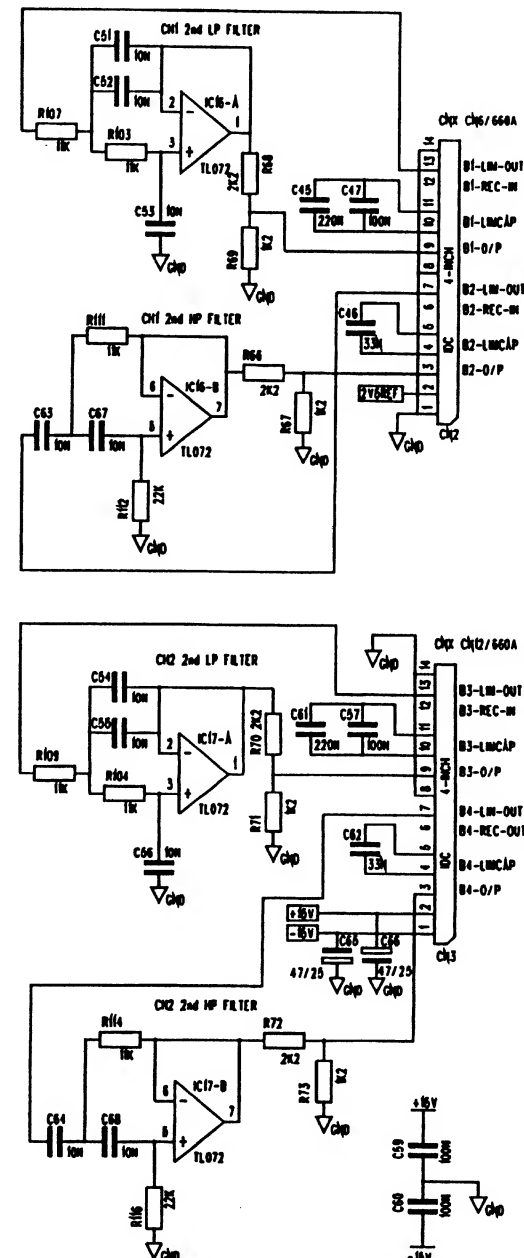
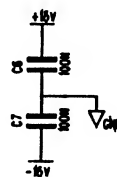
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NOTES



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ISSUE

1

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Fax: 1 (818) 891-9619

TITLE: LEGEND DISPLAY BOARD

FILENAME: 660PB1LAY

DRAWN BY: SJG

DATE: 4-3-93

CHECKED:

LAYERS: SHEET 1 OF 1

ISSUE DETAILS ORIGINAL ISSUE

1. NO SCHEMATIC CHANGES.
2. UP-ISSUED TO KEEP IN LINE WITH PCB ONLY MOOS.

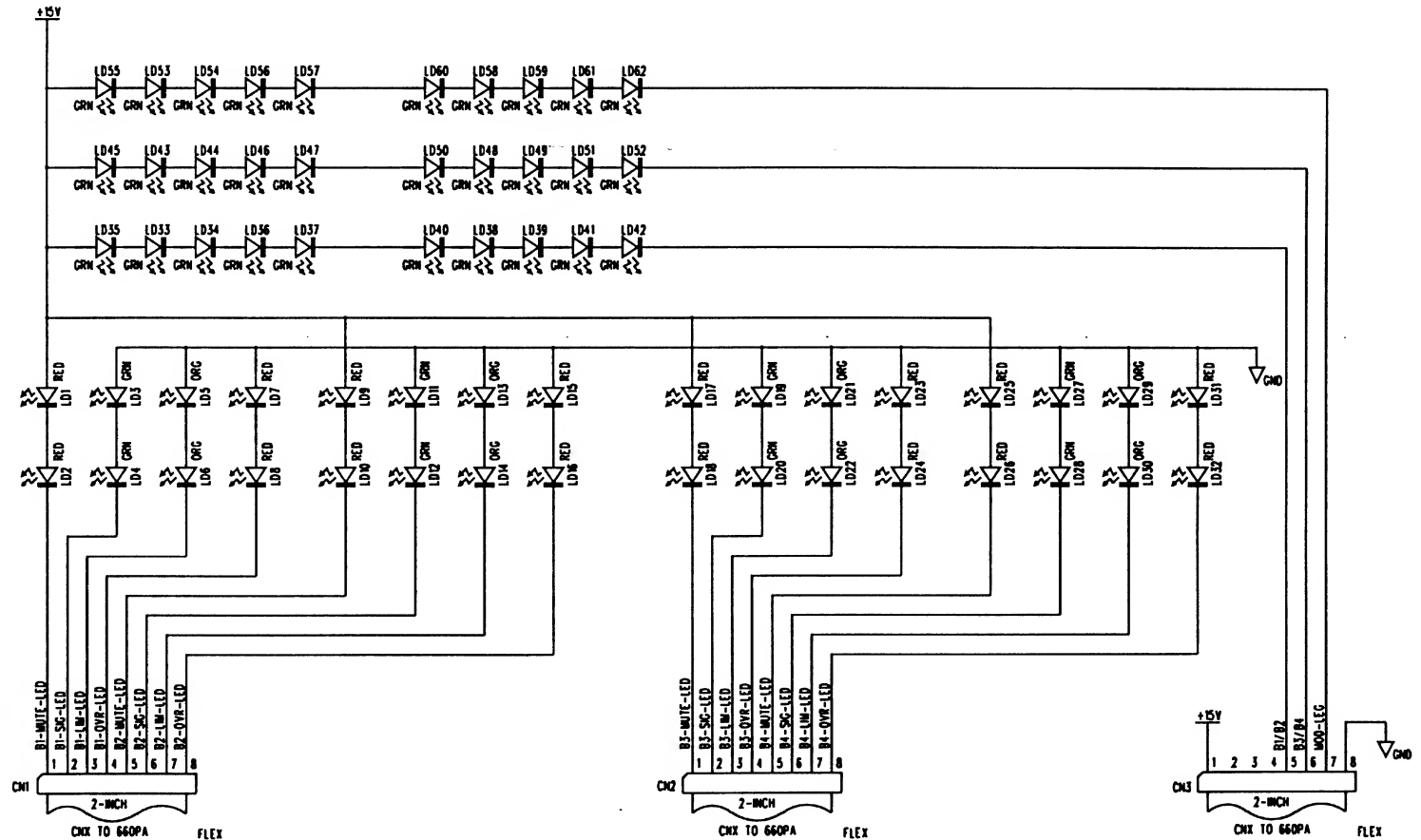
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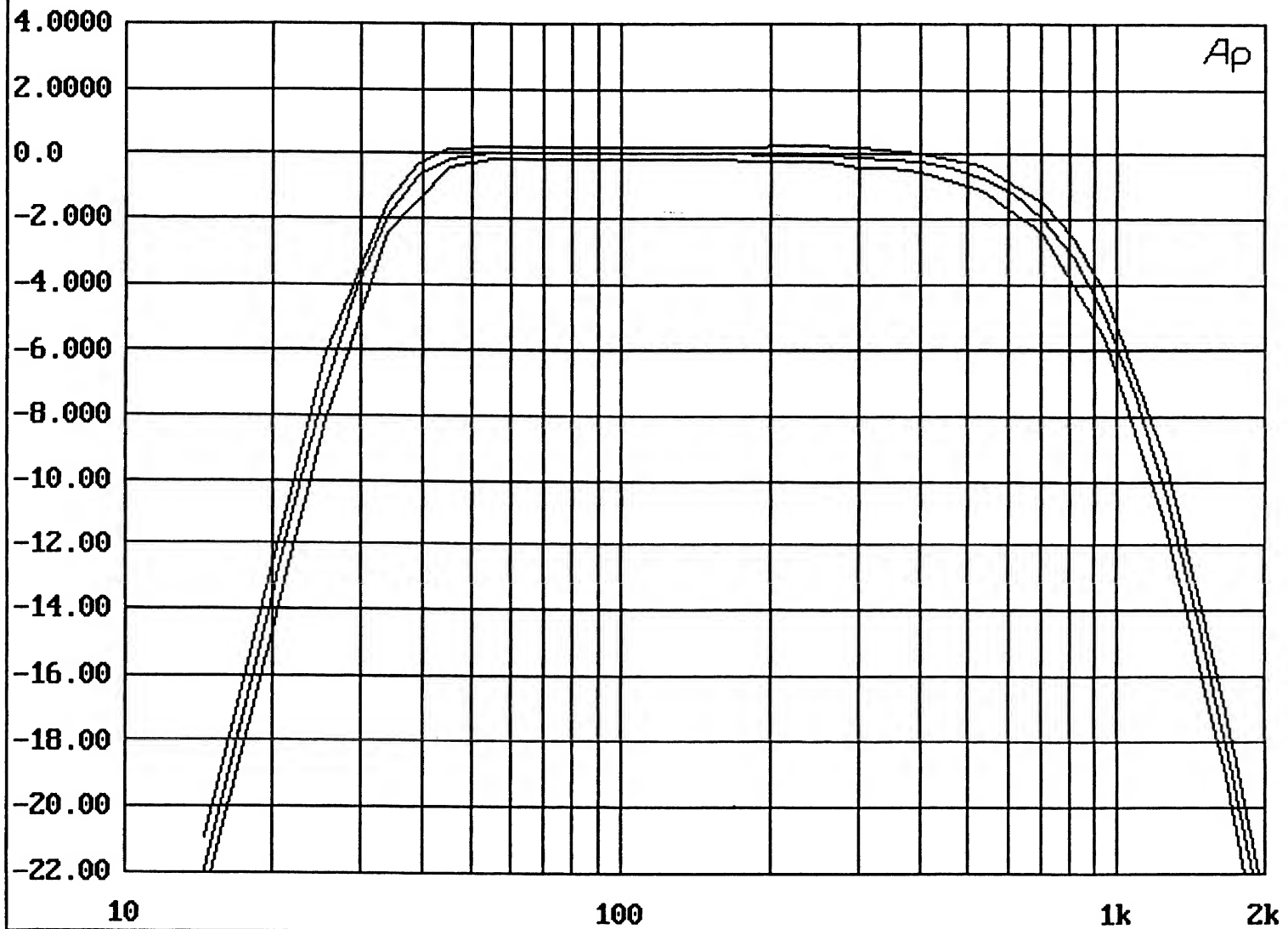
ARTWORK:

NOTES



ASC24 LF SWEEP 664_LF AMPL(dBu) vs FREQ(Hz)

15 DEC 94 13:15:40



ASC24 HF SWEEP 664_HF AMPL(dBu) vs FREQ(Hz)

15 DEC 94 13:15:40

